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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/609,476	07/01/2003	Hirofumi Fujioka	Q76291	2217

23373 7590 08/17/2004

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EXAMINER	
SMOOT, STEPHEN W	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 08/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/609,476	FUJIOKA ET AL.	
	Examiner	Art Unit	
	Stephen W. Smoot	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 July 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *01 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *7-1-03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office action is in response to application papers filed on 01 July 2003.

Specification

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: Method for Manufacturing a Semiconductor Device that Includes Depositing a Metal Oxide Film by Repeating a Dual-Stage Chemical Vapor Deposition Step.

2. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 3, 14, 27 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 3 recites the limitation "said oxidizing gas to be introduced at said first stage" in lines 2-3;

Claim 14 recites the limitation "said oxidizing gas to be introduced at said first stage" in lines 2-3; and

Claim 27 recites the limitation "said oxidizing gas to be introduced at said first stage" in lines 2-3.

There is insufficient antecedent basis for this limitation in claims 3, 14, 27.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States

only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1-4, 6, 8-15, 17, 19-28, 30, 32-35 are rejected under 35 U.S.C. 102(b) as being anticipated by Raaijmakers et al. (US 2001/0024387 A1).

Referring to Figs. 1A, 4A, 5 and paragraphs [0005], [0010], and [0093] to [0099], Raaijmakers et al. disclose an atomic layer deposition method for forming a tantalum oxide layer that includes the following features:

- The tantalum oxide layer can be used as a capacitor dielectric layer (24) that is formed between a lower electrode (22) and an upper electrode (26) in a stacked capacitor formed above a semiconductor substrate (12) as shown in Fig. 1A;
- The lower electrode (22) includes a hemispherical grained silicon (28) textured surface;
- The tantalum oxide layer is formed by alternating pulses of a tantalum ethoxide metal source gas with an ozone oxygen source gas until the desired layer thickness is achieved as shown in Fig. 5 (also see Table II);
- The method includes purging the metal source gas and oxygen source gas between pulses; and
- The ozone flow rate corresponding to an ozone pulse is greater than the tantalum ethoxide flow rate corresponding to a tantalum ethoxide pulse as indicated in Table II.

These are all of the limitations set forth in claims 1-4, 8-10, 12-15, 19-21, 23-28, 32-34 of the applicant's invention.

Regarding claims 6, 17, 30, Raaijmakers et al. disclose another embodiment of depositing a capacitor dielectric by atomic layer deposition that includes using trimethyl aluminum as the metal source gas and water vapor as the oxygen source gas (see Table I and paragraphs [0087] to [0090]) and further disclose surface termination of hemispherical grained silicon by exposure to water vapor to prepare the surface for reaction with the metal source gas (see paragraph [0054]).

Regarding claims 11, 22, 35, Raaijmakers et al. disclose another embodiment of depositing a capacitor dielectric by atomic layer deposition that includes using zirconium chloride as the metal source gas and water vapor as the oxygen source gas (see Table IV and paragraphs [0106] to [0108]), in which the duration of the water vapor pulses exceeds the duration of the zirconium chloride pulses.

7. Claims 1-3, 6-7, 10, 12-14, 17-18, 21, 23-27, 30-31, 34 are rejected under 35 U.S.C. 102(b) as being anticipated by Derderian et al. (US 2002/0025628 A1).

Referring to Fig. 6 and paragraph [0034], Derderian et al. disclose an atomic layer deposition method for forming an aluminum oxide layer that includes the following features:

- The aluminum oxide layer can be used as an insulating barrier layer (10) that is formed between a first capacitor electrode (8) comprising hemispherical grain polysilicon and a second capacitor electrode (14) in a capacitor formed above a substrate (2) as shown in Fig. 6;

- The aluminum oxide layer is formed by alternating pulses of water vapor with trimethyl aluminum until the desired layer thickness is achieved (also see paragraph [0028]);
- The method includes purging the water vapor and the trimethyl aluminum between pulses; and
- Regarding claims 6-7, 17-18, 30-31, the method disclosed by Derderian et al., which pulses with water vapor first, can be interpreted to be a preliminary water vapor step as claimed in claims 6, 17, 30 combined with omission of a final water vapor step as claimed in claims 7, 18, 31.

These are all of the limitations set forth in claims 1-3, 6-7, 10, 12-14, 17-18, 21, 23-27, 30-31, 34 of the applicant's invention.

8. Claims 1-2, 4-6, 10-13, 15-17, 21-22, 25-26, 28-30, 34 are rejected under 35 U.S.C. 102(e) as being anticipated by Haukka et al. (US 2002/0115252 A1).

Referring to Fig. 2 and paragraphs [0066] to [0095], Haukka et al. disclose an atomic layer deposition method for forming an aluminum oxide layer that includes the following features:

- The aluminum oxide layer can be used as an insulating barrier layer that is formed between two conductors in a capacitor structure of an integrated circuit (also see page 10, claim 16);
- The semiconductor substrate surface can be prepared for the atomic layer deposition by an initial water treatment (also see paragraph [0028]);

- The aluminum oxide layer can be formed by alternating pulses of trimethyl aluminum with water vapor until the desired layer thickness is achieved (also see Table I);
- The method includes purging the water vapor and the trimethyl aluminum between pulses;
- Most preferably, 3 to 8 cycles are performed (see paragraph [0074]); and
- As shown in Table I, the duration of the water pulses exceeds the duration of the trimethyl aluminum pulses.

These are all of the limitations set forth in claims 1-2, 5-6, 10-13, 16-17, 21-22 of the applicant's invention.

Regarding claims 4, 15, 25-26, 28-30, 34, Haukka et al. disclose that oxygen-containing aluminum diketonates can be used as the aluminum source gas (see paragraphs [0034] and [0076]).

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen W. Smoot whose telephone number is 571-272-1698. The examiner can normally be reached on M-F (8:00am to 4:30pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 571-272-1702. The fax phone

number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

sws

Stephen W. Smoot
Patent Examiner
Art Unit 2813